# PATENT SPECIFICATION (11) 1 375 159

(21) Application No. 49394/70 (22) Filed 17 Oct. 1970
(23) Complete Specification filed 18 Oct. 1971
(21) Application No. 60864/70 (22) Filed 22 Dec. 1970
(23) Complete Specification filed 18 Oct. 1971
(44) Complete Specification published 27 Nov. 1974
(51) International Classification A43D 95/10//65/00
(52) Index at acceptance
A3B 1B4A 1N 32
B5A 1R27 3DX


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(19)

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## (54) IMPROVEMENTS IN OR RELATING TO SHOEMAKING

(71) We, THE BRITISH UNITED SHOE MACHINERY COMPANY LIMITED a British Company of Union Works, Belgrave Road in the City of Leicester, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with improvements in or relating to shoemaking.

The term "shoe" is used herein generically as including outer footwear generally, including boots, slippers and the like, and is used to include the article during the course of its manufacture.

In the manufacture of shoes it is common practice to subject a shoe upper assembly to a heat treatment operation to impart to the upper assembly some degree of shape retention. When the upper assembly comprises an upper of leather, water is often introduced into the leather prior to the heat treatment to make the leather pliable whereby the upper may be more readily conformed to a desired shape. However, when the upper is of a synthetic plastics material, heat treatment alone is often sufficient to impart a required degree of shape retention to the upper assembly.

We have found that many of the presently available apparatuses and methods for use in the heat treatment of shoe upper assemblies are for example either comparatively time-consuming or impart to the upper assembly an insufficient degree of shape retention.

There will be described hereinafter, to illustrate the invention by way of example, an illustrative method of shoe making, involving the heat treatment of a lasted shoe upper assembly, and two illustrative apparatuses by the use of either of which this illustrative method may be carried out.

Each of the two illustrative apparatuses is adapted for use in the moulding of shoe bottom units on to shoes and comprises a mould assembly comprising a plurality of mould members, including a sole mould member and two side mould members mounted one either side of the sole mould member for movement between open and closed portions, which mould members are adapted to provide, when the side mould members are in their closed positions, a mould cavity in the form of a shoe bottom unit, and a foot form suitable for use in conjunction with the mould assembly and comprising electrical heaters adapted to heat the foot form on which foot form a shoe upper assembly may be mounted, said foot form being movable relative to the mould assembly from a retracted position separated from the mould members to an advanced position in cooperation with the mould members in which position the foot form and a shoe upper assembly mounted thereon closes the mould cavity.

Each of the two illustrative apparatuses comprises heating means comprising two heating devices mounted one on either side of the sole mould member and positioned in a manner such that when the side mould members are in their closed positions heat may be directed by the heating devices on to side portions at least of an upper assembly mounted on a foot form in its advanced position: the heating means may, if desired, comprise further heating devices to direct heat on to toe and heel portions of the upper assembly. Each of the heating means is so constructed and arranged as to not touch the upper assembly during operation of the illustrative apparatuses. The heating devices of both the illustrative apparatuses are adapted to direct radiant heat on to outer surfaces of the upper assembly to heat the side portions of the upper assembly to a temperature higher than that to which the foot

[Price 25p]

form is heated: however under certain circumstances it may be desirable that heating devices adapted to direct hot air on to the upper assembly be used.

In the use of both the illustrative apparatuses, a shoe upper assembly is mounted on the foot form which is then moved to its advanced position, either before closing of the side mould members in a side-closure sequence or after closing of the side mould members in a top-closure sequence. On completion of closing of the mould cavity, a fluid moulding material is injected by injection mechanism of the apparatus into the mould cavity in a moulding operation to provide, on solidification, a shoe bottom unit attached to the bottom of the shoe upper assembly.

The heating means of each of the two illustrative apparatuses comprises a control device upon actuation of which in the use of the apparatus the heating devices are caused to direct heat on to the outer surfaces of the said side portions of an upper assembly closing the mould cavity. In the first illustrative apparatus, the control device is actuated by completion of closing of the mould cavity, either on completion of closing of the side mould members if the foot form is moved to its advanced position prior to closing of the side mould members in a side-closure sequence, or on completion of movement of the foot form to its advanced position if the side mould members are moved to their closed positions prior to movement of the foot form to its advanced position in a top-closure sequence: in the second illustrative apparatus, the control device is actuated on operation of sensing mechanism operative to detect filling of the mould cavity with fluid moulding material to terminate operation of the injection mechanism.

The heating means also comprises an adjustable time device. In addition to actuation of the control device causing the heating devices to be switched on, such actuation starts the time device. After the elapse of the period of time to which the time device is set, the time device switches off the heating devices. Thus, during an initial part of the moulding operation (either in the case of the first illustrative apparatus immediately prior to, and during, injection of fluid moulding material into the closed mould cavity or in the case of the second illustrative apparatus immediately subsequent to completion of such injection and while the mould cavity remains closed by the upper assembly on the footform) the heating devices direct radiant heat on to the said side portions of the upper assembly, and after elapse of said period of time, during a latter, remaining part of the moulding operation, the upper assembly is allowed to cool to the temperature of the foot form.

In carrying out the illustrative method of shoe making, either of the two illustrative apparatuses may be used. Firstly, a shoe upper assembly comprising a fleece-lined vinyl upper is mounted on the foot form which is heated. The foot form is moved to its advanced position, and the side mould members are moved to their closed positions, in a side-closure sequence, closure portions of the side mould members engaging the upper assembly around the feather line thereof, such movement of the side mould members causing movement of the heating devices from inoperative to operative positions. On completion of closing movemnet of the side mould members, the moulding operation is commenced, fluid moulding material being injected by the injection mechanism into the mould cavity. During part of the moulding operation, specifically during an initial part thereof, the heating devices direct radiant heat on to outer surfaces of side portions of the upper assembly and, to a lesser extent, to toe and heel portions thereof, for a period of time of about 15 seconds, heating (in conjunction with the hot foot form) the upper to a temperature at which the upper soitens and contracts and confomrs to the shape of the foot form. After the elapse of the period of time to which the time deice is set, the time device causes the heating devices to be switched off, and the upper assembly is allowed to cool. Cooling of the upper assembly may if desired be expedited by the direction of cool air on to the side portions thereof, and/or by cooling of the foot form. By the time the fluid moulding material in the mould cavity has solidified during the remainder of the moulding operation, the upper has reached a temperature (approximately the temperature of the foot form) at which it is physically stable and retains the shape imparted to it.

In the first illustrative apparatus, the heating devices are fixed one to each of the side mould members. However, the second illustrative apparatus comprises two carrier members one mounted on each side of the sole mould member, the side mould members being mounted one on each of the carrier members. Each heating device is also mounted one on each carrier member, and the carrier members are movable between first positions in which the side mould members are in their closed positions and second positions in which the side mould members are in their open positions.

When the carrier members are in their first positions, the heating devices are in their operative positions close to the upper

assembly in which positions they are adapted to direct radiant heat on to the side portions of the upper assembly. On movement of the carrier members to their second positions, the heating devices are moved generally widthwise of the mould cavity to inoperative positions remote from the upper assembly, such movement of the carrier members moving the heating devices apart a greater distance than that through which the side mould members are moved.

The second illustrative apparatus is particularly advantageous in that the mould members of the mould assembly may be replaced by other mould members with a minimum of inconvenience caused by the heating devices. Additionally, such mounting of the heating devices is more convenient for the use of a foot form assembly comprising two foot forms at least the assembly being rotatably mounted for movement about an axis lying in a plane which extends lengthwise of the mould cavity whereby each foot form in turn may be moved, by rotation of the foot form assembly about said axis, from a loading position into the retracted position preparatory to being moved towards the mould assembly to the advanced position.

This invention provides a method of moulding a shoe bottom unit on to a shoe upper assembly comprising injecting a fluid moulding material into a mould cavity in the form of a shoe bottom unit the cavity being closed by the upper assembly mounted on a footform, and during injection of the fluid moulding material or immediately subsequent to completion of injection of the fluid moulding material while the mould cavity remains closed by the upper assembly on the foot form directing heat on to an outer surface of side portions at least of the upper assembly.

The invention also provides apparatus for use in the moulding of shoe bottom units on to shoes and comprising (a) a mould assembly adapted to provide a mould cavity in the form of a shoe bottom unit which mould cavity may be closed by a shoe upper assembly mounted on a foot form, and (b) heating means adapted to direct heat on to outer surfaces of side portions at least of a shoe upper assembly closing the mould cavity, the heating means being so constructed and arranged as to not touch the upper assembly.

There now follows a detailed description, to be read with reference to the drawings accompanying the provisional specifications, of the illustrative apparatuses and of the illustrative method of shoemaking. It will be appreciated that both the apparatuses and the method have been selected to illustrate the invention by way of example only, and not by way of limitation thereof.

In the drawings accompanying application No. 49394/70:

Figure 1 is a simplified perspective view of part of the first illustrative apparatus; and

Figure 2 is a simplified sectional view taken along the line II-II of Figure 1.

In the drawing accompanying application No. 60864/70:

Figure 3 is a perspective view of the second illustrative apparatus.

Each of the first and the second illustrative apparatus is similar in certain aspects to the machine described by way of example in U.K. Patent Specification No. 1150601 to which reference may be made for details of certain parts of the illustrative apparatus not described in detail herein, and is adapted for use in the moulding of shoe bottom units onto shoes.

The first illustrative apparatus comprises a mould assembly 10, a base plate 8 on which the mould assembly 10 is mounted, a foot form 30 suitable for use with the mould assembly 10, injection mechanism (not shown) and heating means.

The mould assembly 10 comprises a plurality of mould members including a sole mould member 12 secured to the base plate 8 and two side mould members 14 and 16 slidably mounted on the base plate 8 one either side of the sole mould member 12 for movement between open positions separated from the sole mould member 12 and closed positions (shown in the drawings) in which the mould members cooperate to provide a mould cavity 18 in the form of a shoe bottom unit, (see Figure 2).

The foot form 30 is adapted to support a lasted shoe upper assembly, and is one of a pair of opposed foot forms of a foot form assembly rotatably mounted for movement about an axis lying in a plane extending at right angles from the base plate lengthwise of the mould cavity, said axis extending downwardly at 15° to the horizontal towards an operator standing in front of the machine. By rotation of the foot form assembly about said axis, each foot form in turn may be moved between a loading position, in which an upper assembly may conveniently be mounted on the foot form, and a retracted position opposite, and separated from, the mould assembly 10. By movement of the foot form assembly vertically towards the mould assembly, a foot form may be carried from its retracted position into an advanced position in cooperation with the mould assembly in which advanced position the foot form together with a shoe upper assembly mounted thereon closes the mould cavity.

Each foot form of the foot form assembly is adapted to support a lasted shoe upper assembly and comprises heaters adapted to heat the foot form and maintain the foot form hot, said heaters being provided by thermostatically-controlled heating elements 32 (only one of which, is shown, (see Figure 2) and electrical connectors 34 which in the use of the apparatus are connected to a supply of electricity.

The illustrative apparatus may be used in a side-closure sequence, in which one of the foot forms is moved from its retracted to its advanced position prior to movement of the side mould members to their closed positions, welt closure portions 15, 17 of the side mould members 14, 16 respectively engaging the feather line of the upper assembly on movement of the side mould members to their close positions, or in a top-closure sequence in which the foot form is moved to its advanced position subsequent to movement of the side mould members to their closed positions, the upper assembly being moved into a sealing engagement with the welt closure portions of the side mould members.

On completion of closing of the mould cavity, a moulding operation is commenced in which the injection mechanism injects fluid moulding material, provided by molten p.v.c., into the mould cavity. Sensing mechanism of the mould assembly is operative to detect filling of the mould cavity with p.v.c. to terminate operation of the injection mechanism. On solidification of the p.v.c. a moulded shoe bottom unit attached to the bottom of the shoe upper assembly is provided.

The heating means of the first illustrative apparatus comprise two radiant heating devices 22, 24 each comprising a reflector plate and two "Mazda" ("Mazda" is a Registered Trade Mark) infra-red quartz heating elements 23, 23; 25, 25 respectively, each heating element operating at 120 volt/500 watt. The heating devices are mounted one on each side of the sole mould member 12 and are movable generally widthwise of the mould cavity between inoperative positions separated from each other and operative positions in which they are adapted to direct radiant heat on to the outer surface of side portions of a shoe upper assembly mounted on a foot form in its advanced position, and to a lesser extent on to the outer surface of toe and heel portions thereof, and are so arranged that on movement of the side mould members 14, 16 to their closed positions the heating devices are moved to their operative positions, and on movement of the side mould members to their open positions the heating devices are moved to their inoperative positions.

In the use of the first illustrative apparatus, subsequent to completion of closing of the mould cavity and during part at least of the moulding operation, specifically during an initial part thereof, the heating devices are switched on to heat, together with the hot foot form, the upper assembly to a temperature in excess of that to which the foot form is heated. After the elapse of a pre-selected period of time, the heating devices are switched off, and during a latter part of the moulding operation, the upper assembly is allowed to cool.

The second illustrative apparatus is similar in construction and operation to the first illustrative apparatus, as hereinabove described, the same numerals denoting like parts of both illustrative apparatuses but with those of the second illustrative apparatus being given the suffix *a*, (see Figure 3).

In the first illustrative apparatus (see Figure 2), the heating devices 22, 24 are fixed, one to each of the side mould members 14, 16, respectively, by winged bolts 28. The control device comprises a micro-switch 40 mounted on the side mould member 14, and a contact bracket 42 mounted on the side mould member 16 in a position such that on movement of the side mould members into their closed positions the bracket 42 contacts the micro-switch 40. When the first illustrative apparatus is being used in a side-closure sequence, such contact, signalling complete closing the mould cavity, actuates the control device to switch on the heating devices 22 and 24 and to start a time device of the heating means. After elapse of the period of time to which the time device is set (during an initial part of the injection operation) the time device operates to switch the heating devices off.

When the apparatus is being used in a top-closure sequence, selection means thereof over-rides the micro-switch 40 and actuation of the control device is causd by engagement of a second micro-switch (not shown) on completion of movement of the foot form into its advanced position.

In the use of the first illustrative apparatus, the side mould members 14, 16 are connected directly to side mould closing mechanism of the apparatus, and the heating devices 22, 24, being fixed to the side mould members 14, 16, are carried directly between their operative and inoperative positions by movement of the side mould members between their closed and open positions.

The second illustrative apparatus (Figure 3) comprises two carrier members 106, 108 slidably mounted, one either side of the sole mould member 12*a*, on guides 110

provided on the base plate 8*a*. Each of the side mould members 14*a*, 16*a* of the mould assembly 10*a* of the second illustrative apparatus is mounted on one of the carrier members 106, 108, respectively, and in the use of the apparatus mould closing mechanism thereof moves the carrier members between first and second positions, carrying the side mould members between their closed and open positions.

The heating means of the second illustrative apparatus comprises two radiant heating devices 22*a*, 24*a* one mounted on each side of the sole mould member 12*a*, mounted one on each carrier member.

Each carrier member comprises two brackets 122, 122 extending out and upwards therefrom. Each heating device 22*a*, 24*a* comprises two angled arms 128, 128 each pivotally mounted on one of the brackets 122, and the radiant heating elements (not shown) of the heating device 22*a* and the radiant heating elements 25*a* of the heating device 24*a* extend generally lengthwise of the mould assembly between upper portions of the arms 128.

A lower portion 132 of each of the arms 128 is provided with an elongated slot 134. Fixedly mounted on the base plate 8*a*, each comprising an arm 140 extendig adjacent one of the slots 134, are four brackets 138. Each arm 140 is provided with a pin 142 which extends into the slot 134 of the adjacent arm 132, all four pins lying in a plane parallel to the base plate and lying below the levels of the pivots of the four angled arms 128.

On movement of the carrier members 106, 108 towards their first positions, the pins 142 restrain the lower portions 132 of the angled arms 128 and the heating devices 22*a*, 24*a* pivot, about parallel axes, about the mounting of the brackets 122 towards the foot form.

In the use of the second illustrative apparatus, on movement of the carrier members into their first positions to carry the side mould members into their closed positions to complete closing of the mould cavity in a side-closure sequence, the heating devices 22*a*, 24*a* move generally widthwise of the mould cavity about the pivotal mountings of the brackets 122 into their operative positions, in which they are adapted to direct radiant heat on to the outer surface of side portions at least of an upper assembly on the foot form in the advanced position.

In the second illustrative apparatus, the control device of the heating means is actuated by a signal from the sensing mechanism of the mould assembly on filling of the mould cavity with moulding material to terminate operation of the injection mechanism: the heating devices 22*a*, 24*a* are thus switched on, and direct radiant heat on to the outer surfaces of the side portions of the upper assembly on the foot form during that initial part of the moulding operation immediately subsequent to completion of injection of moulding material into the mould cavity. On actuation of the control device, the time device is started, and after the elapse of the pre-selected period of time, the heating devices are switched off. During the remaining, latter part, of the moulding operation, the upper assembly cools.

On completion of cooling of the moulding material, the carrier members 106, 108 are moved to their second positions, carrying the side mould members 14*a*, 16*a* to their open positions and moving the heating devices 22*a*, 24*a* about the pivotal mountings of the brackets 122 into their inoperative positions, the heating devices moving apart a distance, generally widthwise of the mould cavity, greater than that moved by the side mould members.

The foot form 30*a* is lifted from its advanced to its retracted position with a completed shoe thereon, and the foot form assembly is rotated about its axis to carry the said foot form to its loading position at which the completed shoe is slipped from the foot form.

In carrying out the illustrative method of shoemaking, either of the two illustrative apparatuses may be used. A flat-lasted shoe upper assembly *A*, comprising a vinyl upper *u*, a fleece lining *L* and an insole *I* is mounted on the foot form 30 in the loading position, the foot form 30 being heated by the heating elements 32 to about 90°C. The foot form is moved to its retracted and then to its advanced position and the side mould members 14 and 16 are moved to the closed positions in a side-closure sequence, such movement of the side mould members causing movement of the heating devices to their operative positions.

On completion of closing of the side mould members a moulding operation is commenced which moulding operation involves the injection of molten p.v.c. by the injection mechanism into the mould cavity 18, and cooling and solidification of the p.v.c. to provide a moulded shoe bottom unit attached to the upper assembly *A*.

During an initial part of the moulding operation, the heating devices are switched on and direct radiant heat on to side portions of the upper assembly *A*.

When the first illustrative apparatus is used in carrying out the illustrative method, on completion of closing of the side mould members, the bracket 42 contacts the micro-switch 40 causing actuation of the control device to switch on the heat-

ing devices, whilst the foot form is still in a heated condition, for a period of time determined by the time device, the heating devices so directing radiant heat immediately subsequent to closing of the mould cavity and during injection of fluid moulding material into the mould cavity. When the second illustrative apparatus is used in carrying out the illustrative method, on completion of filling of the mould cavity, the sensing mechanism causes termination of the injection of moulding material and causes actuation of the control device to switch on the heating devices for said period of time. The time device is so set that the period of time for which the heating devices so direct radiant heat is sufficient for the upper to be heated, by both the foot form and the heating devices, to a temperature at which the upper softens and contracts, conforming as it does so to the shape of the foot form. After the elapse of this period of time, the time device switches the heating devices off. During the remainder of the moulding operation, during which the injected p.v.c. is solidifying, the upper is allowed to cool to a temperature approximately that of the foot form at which it is physically stable and may be removed from the foot form. Such cooling may if desired be facilitated by directing cool air onto the upper assembly, or by switching off the heating elements 32 and applying a cooling fluid to the interior of the foot form.

WHAT WE CLAIM IS:—

1. A method of moulding a shoe bottom unit on to a shoe upper assembly comprising injecting a fluid moulding material into a mould cavity in the form of a shoe bottom unit the cavity being closed by the upper assembly mounted on a footform, and during injection of the fluid moulding material or immediately subsequent to completion of injection of the fluid moulding material while the mould cavity remains closed by the upper assembly on the footform directing heat on to an outer surface of side portions at least of the upper assembly.

2. A method according to claim 1 wherein the footform is heated during the moulding operation whereby to heat an inner surface of the upper assembly.

3. A method according to either one of claims 1 and 2 wherein the mould cavity is provided by a mould assembly comprising mould members movable relative to each other between open and closed positions in which closed positions the mould assembly provides said mould cavity.

4. A method in accordance with claim 3 wherein the heat is directed on to the said side portion for a pre-selected time immediately subsequent to closing of the mould cavity.

5. A method in accordance with any one of the preceding claims wherein during a latter part of the moulding operation the said side portions of the upper assembly are cooled, or are allowed to cool.

6. A method in accordance with any one of the preceding claims wherein the heat directed on to the said side portions is radiant heat.

7. Apparatus for use in the moulding of shoe bottom units on to shoes and comprising (a) a mould assembly adapted to provide a mould cavity in the form of a shoe bottom unit which mould cavity may be closed by a shoe upper assembly mounted on a foot form, and (b) heating means adapted to direct heat on to outer surfaces of side portions at least of a shoe upper assembly closing the mould cavity, the heating means being so constructed and arranged as to not touch the upper assembly.

8. Apparatus in accordance with claim 7, wherein the mould assembly comprises a sole mould member and two side members mounted one either side of the sole mould member for movement relative thereto between open and closed positions in which closed positions of the side members the mould assembly provides said mould cavity, the heating means comprising two heating devices one mounted on each of the side members.

9. Apparatus in accordance with claim 8 wherein each heating device is fixed relative to its associated side member.

10. Apparatus in accordance with claim 7 wherein the mould assembly comprises (a) a sole mould member; (b) two carrier members mounted one either side of the sole mould member; and (c) two side members one mounted on each of the carrier members, the heating means comprising two heating devices one mounted on each of the carrier members, the carrier members being movable between first positions in which the side members are in closed positions engaging the sole mould member and providing together with the sole mould member said mould cavity and second position in which the side members are in open positions separated from the sole mould member, movement of the carrier members from their first to their second position moving the heating devices from operative positions in which they are adapted to direct heat onto the said side portions of a shoe upper assembly closing the mould cavity to inoperative positions remote from said upper assembly.

11. Apparatus in accordance with one of claims 8 and 10 wherein on movement of the side members from their closed to

their open positions the heating devices are moved apart a greater distance than that through which the side members are moved.

12. Apparatus in accordance with any one of claims 8, 10 and 11 wherein on movement of the side members from their closed to their open positions, the heating devices are moved linearly apart, generally widthwise of the mould cavity, and pivotally, in opposite directions, about parallel axes extending generally lengthwise of the mould cavity.

13. Apparatus in accordance with any one of claims 9, 10, 11 and 12 wherein the heating means comprises a time device and a control device, upon actuation of which control device the heating devices are switched on and direct heat to the said side portions of an upper assembly closing the moud cavity for a period of time determined by the time device.

14. Apparatus in accordance with claim 13 comprising a foot form mounted for movement relative to the mould assembly between a retracted position separated from the mould assembly and an advanced position in which the foot form and a shoe upper assembly thereon close the mould cavity, the control device being actuated either on completion of movement of the side members into their closed positions when the apparatus is used in side-closure sequence or on completion of movement of the foot form into its advanced position when the apparatus is used in a top-closure sequence.

15. Apparatus in accordance with claim 14 comprising injection mechanism adapted to inject a fluid moulding material into the mould cavity when closed by a shoe upper assembly, the mould assembly comprising sensing mechanism operative to detect filling of the mould cavity with fluid moulding material to terminate injection of moulding material into the mould cavity, said sensing mechanism also being operative on such detection to actuate the control device.

16. Apparatus for use in the moulding of shoe bottom units on to shoes and comprising (a) a mould assembly adapted to provide a mould cavity in the form of a shoe bottom unit, (b) a foot form adapted to support a shoe upper assembly and mounted for movement relative to the mould assembly between retracted and advanced positions in which advanced position the foot form and a shoe upper assembly mounted thereon are adapted to close the mould cavity, and (c) two heating devices mounted one enither side of the mould assembly and adapted to direct heat on to opposite side portions of an upper assembly mounted on the foot form when in its advanced position without touching the upper assembly, said heating devices being mounted for movement generally widthwise of the mould cavity between operative positions close to the upper assembly and inoperative positions separated therefrom.

17. Apparatus in accordance with any one of claims 8, 9, 10, 11, 12 and 13 comprising a foot form mounted for movement relative to the mould assembly between a retracted position separated from the mould assembly and an advanced position in which the foot form and a shoe upper assembly thereon are adapted to close the mould cavity.

18. Apparatus in accordance with any one of claims 14, 15, 16 and 17 comprising heaters to heat the foot form.

19. Apparatus in accordance with any one of claims 14, 15, 16, 17 and 18 wherein the foot form is part of a foot form assembly comprising two foot forms at least the assembly being rotatably mounted for movement about an axis lying in a plane which extends lengthwise of the mould cavity whereby each foot form in turn may be moved, by rotation of the foot form assembly about said axis, into a retracted position preparatory to being moved towards the mould assembly to an advanced position.

20. A method of shoemaking when carried out substantially as hereinbefore described with reference to the drawings accompanying the provisional specifications.

21. Apparatus constructed arranged and adapted to operate substantially as hereinbefore described with reference to the drawings accompanying patent application No. 49394/70.

22. Apparatus constructed arranged and adapted to operate substantially as hereinbefore described with reference to the drawings accompanying patent application No. 60864/70.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1974.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1375159 PROVISIONAL SPECIFICATION No.4939470

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

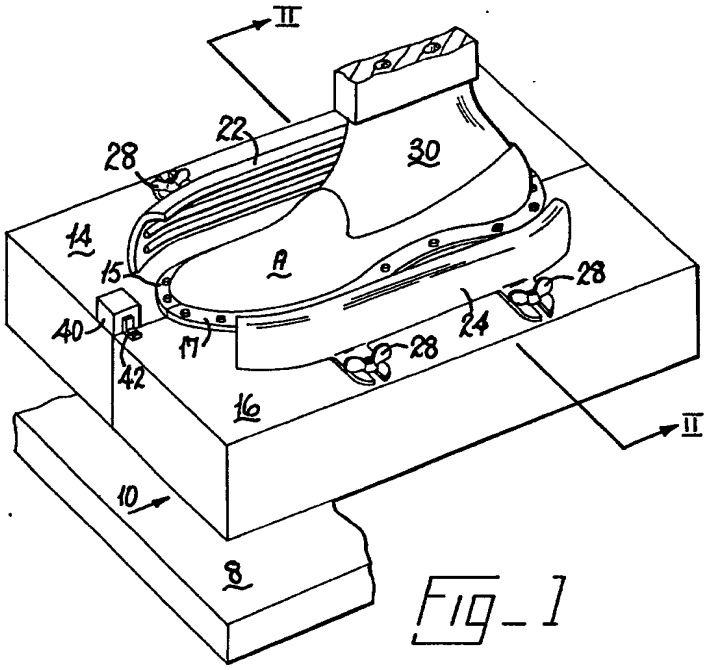


Fig_1

1375159 PROVISIONAL SPECIFICATION No.4939470
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Sheet 2

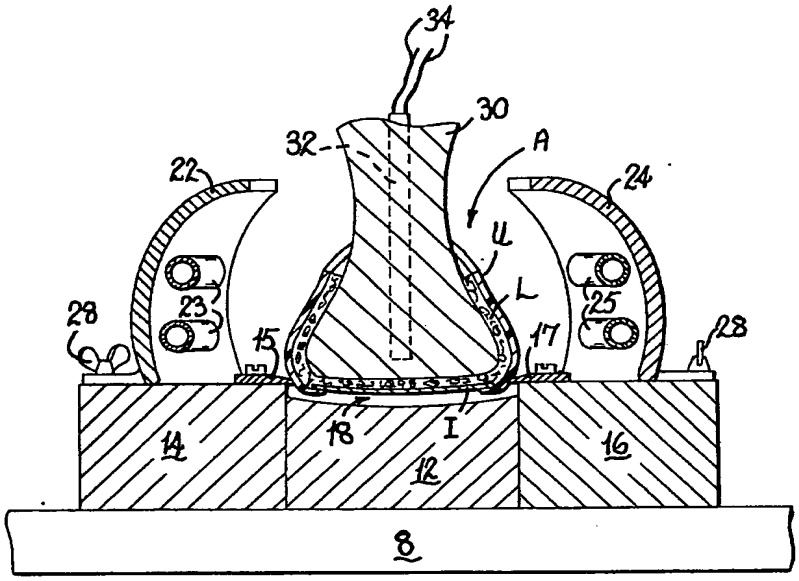


Fig_2

1375159 PROVISIONAL SPECIFICATION No. 60864/70

1 SHEET

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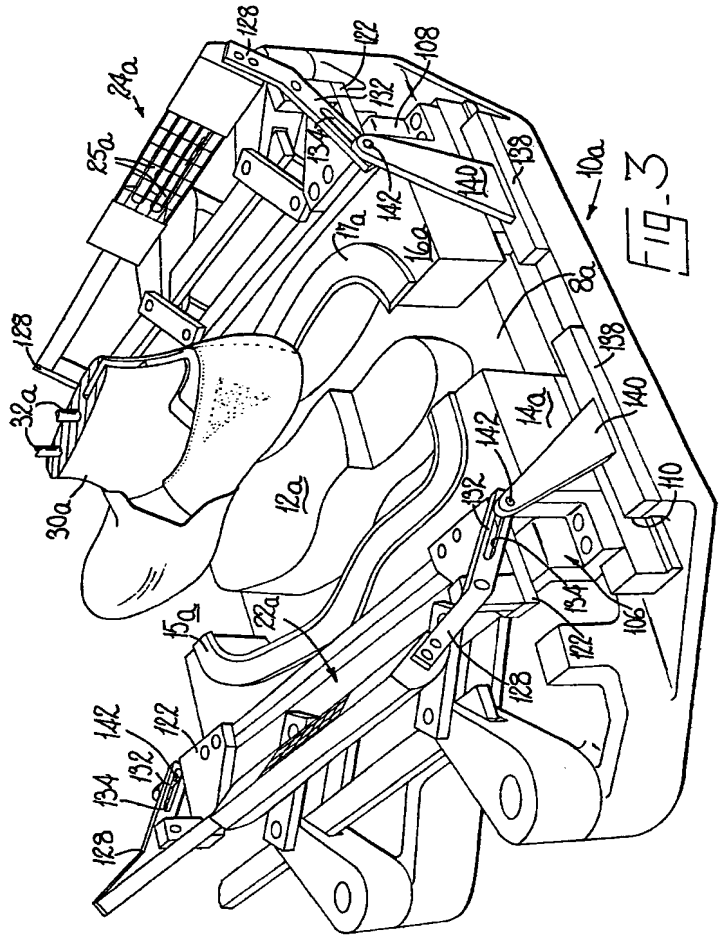


FIG. 3